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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,078	04/12/2001	David A. Thompson	45-35	1456

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EXAMINER
LOUIE, WAI SING

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 06/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/833,078	THOMPSON ET AL.	
	Examiner	Art Unit	
	Wai-Sing Louie	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7,15,16 and 22-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,15,16 and 22-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 15-15 and 25 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- In claim 15-16 and 25, how can a "low temperature grown" and a "spatially varied thickness" InP layer changes its own bandgap energy and affects the emission wavelength of the device.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4, 15-16, and 23-24 (in so far as they are understood) are rejected under 35 U.S.C. 103(a) as being unpatentable over Takiguchi et al. (US 5,671,242), previously used, in view of Elman et al. (US 5,238,868), previously used.

With regard to claims 1 and 3, Takiguchi et al. disclose the method of manufacturing a quantum well structure (col. 5, line 15 to col. 11, line 17 and fig. 1) comprising:

- Providing a quantum well structure comprising an indium gallium arsenide phosphide (InGaAsP) quantum well active region (col. 5, lines 17-34 and fig. 1);
- Takiguchi et al. disclose an InP containing layer 13b, but do not disclose providing the layer with phosphorus vacancy type defects on top of the quantum well structure. However, Elman et al. disclose by inter-diffusing the arsenic vacancies from the created disordered region 11 into the quantum well active region (Elman col. 2, lines 44-47). Elman et al. teach the quantum well bandgap could be tuned by this intermixing technique without inducing defects or causing damages into the quantum well (Elman col. 2, lines 47-53 and 10-14). Therefore, it would have been obvious to one with ordinary skill in the art to modify Takiguchi's device with the teaching of Elman et al. to use the quantum well intermixing technique. Doing so could tune the bandgap of the quantum well active region without causing damages in the active region. Elman et al. do not disclose the phosphorus vacancies intermixing, however, arsenic and phosphorus are Group V elements. If the technique could apply to arsenic, it would be able to apply to phosphorus too;
- Takiguchi et al. do not disclose applying a rapid thermal annealing (RTA) process for controlling diffusion of the phosphorus vacancy type defects into the InGaAsP quantum well active region. However, Takiguchi et al. modified by Elman et al. above would have an InP layer containing vacancy defect. Elman et al. disclose RTA to generate inter-diffusion of defects into the quantum well active region (Elman col.

2, lines 44-47 and col. 4, lines 20-22). Therefore, it would have been obvious to one with ordinary skill in the art to modify Takiguchi's device with the teaching of Elman et al. to thermal anneal the structure in order to generate the quantum well intermixing.

With regard to claims 2 and 4, Takiguchi et al. do not disclose the InP layer is epitaxial grown by means of molecular beam epitaxy (MBE). However, it is common in the art to select the MBE, which is the best technique to form the semiconductor compound including the selected defects in the layer, such as disclosed in Elman et al. at low temperature (Elman col. 4, line 7). Takiguchi et al. modified by Elman et al. do not disclose antisite defects. However, Elman et al. disclose the diffusion of defects in the same manner, as the present application, therefore, the sitting of molecular structure must be the same.

With regard to claim 8, Takiguchi et al., modified by Elman et al. in claim 1 above, disclose the vacancy type of defects in the first indium phosphide layer. Elman et al. disclose the inter-diffusion into the InGaAsP quantum well active region and tune the bandgap energy of quantum well (Elman col. 2, lines 24-29).

With regard to claims 15-16 and 23-25, Takiguchi et al. do not disclose the thickness of the low temperature grown InP layer is in a range of 0-140 nm or more. However, since the applicant has not established the criticality of the thickness stated and since this thickness are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use this value in the device of the thickness. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F2d 1575, 1578, 16 USPQ2d

1934, 1936 (Fed. Cir. 1990). Haysom et al. disclose the annealing is done in a single thermal anneal step (Haysom page 56, right column).

Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takiguchi et al. (US 5,671,242) modified by Elman et al. (US 5,238,868) as applied to claim 1 above, and further in view of Yamazaki et al. (US 5,923,968).

With regard to claims 5-7, Takiguchi et al. modified by Elman et al. do not disclose growing the first InP layer with phosphorus vacancy type defects using helium-plasma assisted MBE or disclose exposing the InP layer to a flux of helium particles to produce the vacancy defects. However, Yamazaki et al. disclose using helium plasma treatment to deform the crystalline (Yamazaki col. 12, lines 40-45). Yamazaki et al. teach the helium plasma treatment MBE process could produce extremely high crystallinity film (Yamazaki col. 12, lines 32-38). Therefore, it would have been obvious to one with ordinary skill in the art to use helium-plasma assisted MBE to form the first InP layer in order to produce a high crystallinity film.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takiguchi et al. (US 5,671,242) in view Freundlich et al. (US 5,851,310).

With regard to claim 22, Takiguchi et al. do not disclose the InP layer is grown by means of a reduced temperature MBE process at a temperature of 300 °C. However, Freundlich et al. disclose the condition of growth by MBE system (Freundlich col. 4, line 49) at a lower temperature of 300 °C (Freundlich col. 6, line 39). Freundlich et al. teach the low temperature

prevents the degradation of the characteristic (i.e., uniformity in composition or thickness) of the semiconductor layer (Freundlich col. 4, lines 30-46). Therefore, it would have been obvious to one with ordinary skill in the art to modify Takiguchi's device with the teaching of Freundlich et al. to provide a low temperature of 300 °C in order to produce a uniform semiconductor layer.

Response to Arguments

Applicant's arguments filed 5/23/03 have been fully considered:

- Applicant has filed a Declarations under C.F.R. 1.131 to remove Haysom et al. as prior art.
- Applicant argues that Yamazaki et al. provides no teaching or suggestion that helium-plasma assisted MBE used to form one layer would have any benefiticial effects in the diffusion of defects to another layer. However, Takiguchi et al. modified by Elman et al. would disclose a MBE low temperature grown InP layer with vacancy defects (see claim 2 above) deposited on top of the MQW. Yamazaki et al. teach the helium plasma treatment MBE process could produce extremely high crystallinity film (Yamazaki col. 12, lines 32-38). Therefore, that is the motivation to combine Takiguchi et al., Elman et al., and Yamazaki et al.
- Applicant argues that low temperature grown does not indicated 300°C. The temperature of 300°C is considered to involve routine optimization, which has been held to be within the level of ordinary skill in the art. As noted in In re

Aller, the selection of reaction parameters such as temperature would have been obvious:

> "Normally, it is to be expected that a change in temperature, or in thickness, or in time, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
>
> *In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any temperature suitable to the method of the process in order to optimize the design.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the

organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsl
June 9, 2003

LONG PHAM
PRIMARY EXAMINER